

XLIII.—On the Structure of the Cocoon of a Leech. By J. S. BOWERBANK, F.R.S., L.S. &c.

[With a Plate.]

At the first view, I believed that the very curious body which is the subject of the present communication was one of the singular aberrant forms of that exceedingly variable tribe the *Spongiadæ*, and until I received a note from Professor Henslow, kindly intimating the probability that I had fallen into an error in thus designating it, I entertained not the slightest doubt of its being one of the numerous odd forms that abound among the sponge tribe, and especially so from the remarkably abundant and deceptive sponge-like tissue with which the body of the cocoon is enveloped.

The distinct coriaceous body with its mammillated terminations, so unlike the great mass of the *Spongiadæ*, would naturally have made it the type of a new genus, and as such I had described it. I am therefore the more anxious that this error should be repaired as completely as possible, and to prevent the chance of its recurrence, I have thought it advisable to describe the structure and peculiarities of this curious little body, although other cocoons somewhat similar have already been to a certain extent made known to the scientific world through the works of Dr. James Rawlins Johnson on the Medical Leech, and of Dr. Noble. The first of Dr. Johnson's memoirs was published in the year 1816, and the second in 1825, and that of Dr. Noble in the year 1822. In the latter treatise of Dr. Johnson we have engravings of the cocoon of the medicinal leech from drawings by Mr. Clift, and also from a cocoon sent to the author by Dr. Noble; and in a subsequent portion of the work we have the cocoons of *Hirudo vulgaris* figured and described; but in neither of these can we recognise the distinct and singular sponge-like fibrous envelopment of the species I am about to describe, and the cocoon of the latter species especially appears from the figures to be completely destitute of any such appendage. It is therefore probable that the subject of the present memoir is the cocoon of *Hirudo sanguisuga*, the common horse leech, an animal which differs very considerably both in structure and habit from the before-named species; or it is a species, the cocoon of which has not hitherto been described.

Dr. Noble designates the cocoon which was the subject of his observations as being of the size and figure of that of the silkworm, and as having the same appearance and density as a piece of fine sponge, but although the description in the latter respect agrees with the one I have to describe, the figure of it in Dr. Johnson's work is evidently that of a different species.

The one which I am about to describe was found in a large muddy ditch, which is on the left hand of the foot-path from Tenby to Pinally, South Wales. It is of an oval form, and rarely exceeds half an inch in length from one extremity of the fibre to the other, and the central case is about four lines long. The fibres are of a greenish amber colour, the case partaking of the same hue, but much deepened by its greater degree of density. Pl. XVIII. fig. 2. represents a specimen of rather more than the average size. When carefully denuded of the surrounding fibre, the case is found to be divided into numerous nearly equal-sized polygonal areas, which are most frequently five- or six-sided. These are produced by a raised network of fibrous structure, partly imbedded in the surface. From the angles of these reticulations the surrounding open fibrous structure springs, which preserves the same form of reticulation as that of the parent surface. Pl. XVIII. fig. 1. represents the same specimen as figure 2, but magnified ten diameters.

The case has frequently a deep sinus which extends entirely across it, causing it to assume very much the same form as a short, swollen grain of wheat, as represented by figure 4; and under these circumstances the mammæ are found opposed to each other in the direction of, what is then, the short axis of the case, and are situated just without the outer edge of the sinus. When there is no depression of this body, the mammæ are found opposed to each other at the ends of the cocoon, as represented by Pl. XVIII. fig. 3.

The sinus is produced by a partial state of collapse of the body of the cocoon, caused apparently by the gradual diminution of its gelatinous contents.

The cocoon in almost every specimen that I have opened was found to contain a dense opaline gelatinous matter. When removed it readily separates in water into flaky masses, which, when viewed by transmitted light with a power of 500 linear, appeared to be composed of exceedingly minute granules.

Upon carefully examining the gelatinous contents of several specimens which I opened, I found in two of them small vesicular bodies, which have every appearance of being the eggs or embryos of the animal. In the gelatinous matter of one specimen I found ten of these bodies, and in another six of them, apparently in different stages of development. They are usually pyriform, and have frequently a deposit of minute, dark, granulated matter towards the smaller end. In both cases in which these bodies occurred, they were found in greater quantities at one end of the cocoon than at the other. Pl. XVIII. fig. 7. represents one of the best-developed of these embryos by transmitted light and a power of 300 linear. The network which covers the outer sur-

face of the body of the cocoon and bounds the deeply sunken areas of its interstices rises from its surface in the form of a sharp edge, and as the free fibres are given off at the angles where the imbedded fibres meet, they naturally at this point assume the form of a three-winged fibre, and this form they maintain throughout the whole of their length, as represented by Pl. XVIII. fig. 8. with a linear power of 94.

Every one is familiar with the horny cases surrounding the ova of certain fishes, and of the finely-spun horny threads with which they are fixed to the stems of Gorgonias and other bodies; but in these cases the fibre is simple and cylindrical, as might naturally be expected, while in the fibrous tissue of this singular cocoon it is three-winged, and anastomoses as regularly and as beautifully as the fibres of the horny sponges of commerce. How the animal produces this beautiful and complex structure, is a question which it will be exceedingly interesting hereafter to solve.

The coriaceous substance of the body is of about the thickness of a stout sheet of writing-paper, the centres of the areas being much thinner than the other parts. When a section of one of its thickest portions at right angles to its outer surface was examined by transmitted light with a power of 94 linear, it appeared to be composed of four or five layers of nearly equal thickness, as represented by Pl. XVIII. fig. 10. When the exterior surface was examined under similar circumstances with a power of 1000 linear, numerous cytoblastic vesicles were observed irregularly dispersed over its surface, but without the appearance of nuclei; but, on the contrary, when the inner surface was thus examined, it was seen to be nearly uniformly covered with well-defined nucleated cytoblasts, the nuclei in many cases being angular, as represented with a power of 1000 linear by Pl. XVIII. fig. 9. From the laminated structure exhibited in figure 10, it is probable that the production of tessellated cellular tissue is not continuous, but that it occurs at intervals, and is produced by a series of efforts, in a similar manner to that in which the successive layers of cartilaginous substance are produced by *Helix aspersa* when about to extend the lip of its shell in the spring of the year. But there is an essential difference in the circumstances of the two cases. In the shell the cytoblasts are developed and their peculiar office performed while in contact with the living body whence they emanate, while in the cocoon this cannot well be the case, as the animal immediately separates itself from it. Their presence and development therefore appear to indicate that vitality to a certain degree remains in the horny substance of the cocoon, and which vitality may probably continue in action until the proper office of the cocoon has been attained. Dr. Johnson, in treating of *Hirudo vulgaris*, describes the singular mode of the production of the co-

coon of that species in this manner. When the animal is about to produce one of these bodies, it is observed to be greatly contracted both above and below the uterus, a distension then takes place between these constrictions, and a surrounding membranous structure is thrown off which becomes of a milky white colour; into this the animal forces with some effort the whole contents of the uterus. This done, it elongates the anterior portion of the body, and withdraws its head as from a collar. After the animal has firmly fixed it to some substance, it fashions it with its mouth until it presents an oval form.

This description enables us in some measure to account for the mammæform appendages of the horny case of the species under consideration, and which differs somewhat in the structure of these parts from all the cocoons described by Dr. Johnson, in which, instead of the protuberant mammæ, we find simply circular orifices; but it does not in any shape enlighten us upon the mode of the construction of the extraordinary and complex spongy tissue which surrounds our species of cocoon.

The mammæform ends of the cocoon are of an oval form, and project in about an equal degree beyond the inner and outer surfaces previously to their becoming perforated, and the length of the oval is somewhat increased by a considerable thickening of the substance of the body immediately surrounding them. The communication between the inner and outer surfaces appears to be effected in a very singular manner. In one case where I made a section of one of these organs at right angles to the natural surfaces of the body, it appeared perfectly solid; in another a small cavity only existed near the inner surface of the case; but in a third specimen the appearance presented was of an exceedingly singular description. The outer end of this organ had a small irregular perforation which led into an ovoid cavity immediately beneath, and the long axis of which was in a diagonal direction as regards the axis of the body of the cocoon, and the inner surface of this cavity appeared to be furnished with three or four ribs, as represented by Pl. XVIII. fig. 5. with a power of 94 linear, and Pl. XVIII. fig. 6. with a power of 160 linear. Upon opening the cocoon I found that the opposite end of the mamma had disappeared, and in lieu of solid substance there was a large dome-shaped cavity, the top of which was separated from the inner end of the ovoid cavity in the external end by a very thin layer of horny structure; and indeed at one spot there were appearances as if a minute communication existed between them, but from the oblique position of the ovoid cavity I could not determine this with certainty. The other extremity of the cocoon did not exhibit precisely the same appearances; in this case the entrance to the ovoid cavity was much larger on the outer surface,

while on the inner one the entrance to the large cavity was closed by an apparently stout membrane.

In other specimens which I examined, sometimes neither of the mammæ were perforated; at others one would be slightly open, while the opposite one was entirely closed. Whether the curious conformation of these parts is the result of accident occurring at the moment of the withdrawal of the leech from the young and tender cocoon, or whether it arises from a vital action inherent in this body and essential to the opening of this organ and the consequent liberation of the young contained within it, it is difficult to conjecture; but I am inclined to believe in the latter idea, and more especially so, as in by far the greater number that I have examined no perforation existed, although, from Dr. Johnson's account of other species, this is evidently the point at which the young effect their liberation.

XLIII.—Description of three new species of *Rubus*.

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1. *Rubus tenuis*. Caule procumbente, tereti, subglauco aculeis æqualibus, foliis ternatis, rarius quinatis, supra subglabris, subtus pubescentibus; foliolis obovato-acuminatis, duplo serratis; lateralibus extrorsum lobatis; panicula decomposita, rarius cymosa; calycibus pubescentibus, lanceolatis acuminatis, fructui adpressis; fructu parvo, nigro, drupeolis paucis, magnis composito.

Var. β. ferox, aculeis crebris, uncinatis.

Syn. *Rubus affinis* δ. *W. et N. Rubi Germ.* p. 3. tab. 3 b. *Rubi cæsi* et *R. corylifolii* pars *auct. var.*

Hab. in variis locis in Britannia australi. *Var. β.* hab. ad "Apes Down" in Insula Vecte.

The habit of this bramble comes so near to that of *Rubus cæsius*, that there can be little doubt it may be often overlooked as being the ordinary dewberry; it is however readily distinguished from that species by the absence of glands generally, and by the absence of both glands and hairs from the growing shoot, and also by the berry being black instead of blue as in the true *R. cæsius*; the calyx embraces it precisely as in that species, but the sepals are rather more broadly lanceolate. The flavour of the fruit differs considerably, that of *R. tenuis*, though acid like that of *R. cæsius*, not having the peculiarly grateful lemon flavour of that species. *Rubus affinis* (*W. et N.*) is described in the 'Rubi Germanici' as having the calyx reflexed, yet one of the varieties is figured with the calyx embracing the fruit. As this is the principal character which distinguishes the present species from *R. affinis*, I can entertain no doubt that the variety (δ.) there figured is in fact the one now described as a distinct species. It holds a near affinity both with *R. cæsius* and *R. affinis*, but having